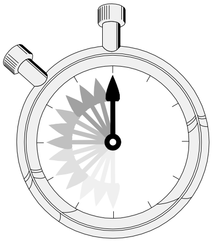
National Institute of Standards and Technology (NIST)

WWV 10 MHZ RECEIVER



Ramsey Electronics Model No. HFRC1

Does anybody really know what time it is? This professional quality receiver is designed to tune the National Institute of Standards and Technology (NIST) atomic clock for moment by moment accuracy ! A great novelty radio that actually seves a useful purpose. Put one in the boat or on a desk...you'll always know what time it is !

- **Sensitive...you bet ! Receiver chip specified at less than 1 microvolt sensitivity!**
- **Runs on 9-12 volts DC ; internal power regulation for "rock solid" performance.**
- **Super easy no tuning required design. Just assemble it up and listen !**
- **Small enough to fit in a variety of locations... ideal for the Ham shack or desktop.**
- **Utilizes the Motorola ® 3371 receiver mixer / oscillator integrated circuit for worry free operation.**
- **Convenient earphone output for earphone / headset operation.... listen in peace!**
- **Complete and informative instructions guide you to a kit that works the first time, every time - enhances resale value, too !**

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HFRC 10 MHZ RECEIVER KIT INSTRUCTION MANUAL
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INSTRUCTION MANUAL FOR

10 MHZ National Institute of Standards and Technology (NIST) Receiver

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INTRODUCTION

People have always been fascinated with the measurement and properties of time. What happened to that last second that you just spent reading this sentence?

Perhaps this is the reason that so many of us have tuned in over the years to the National Institute of Standards and Technology (NIST) “clock” operating at a transmitting frequency of 10 MHz. The cesium standard NIST-7 comes has an accuracy of 5×10^{-15} seconds. Now that's accurate! In fact, the definition of a “second” is "the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom. Try that one on your favorite physics professor!

We set our clocks, watches, and chronometers to the all important “beep” of the radio signal that denotes the correct time to the second. In addition; avid listeners of the NIST clock are also treated to the following (from the NIST web site):

The OMEGA Navigation System status reports are voice announcements broadcast on WWV at 16 minutes after the hour. The OMEGA Navigation System consists of eight radio stations transmitting in the 10- to 14-kHz frequency band. These stations serve as international aids to navigation. The status reports are updated as necessary by the U.S. Coast Guard.

Current geophysical alerts (Geoalerts) are broadcast in voice from WWV at 18 minutes after the hour. The messages are less than 45 s in length and are updated every 3 hours (typically at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 UTC). Hourly updates are made when necessary.

Marine storm warnings are broadcast for the marine areas that the United States has warning responsibility for under international agreement. The storm warning information is provided by the National Weather Service. Storm warnings for the Atlantic and eastern North Pacific are broadcast by voice on WWV at 8, 9, and 10 minutes after the hour. An additional segment (at 11 minutes after the hour on WWV) is used occasionally if there are unusually widespread storm conditions. The brief voice messages warn mariners of storm threats present in their areas.

The storm warnings are based on the most recent forecasts. Updated forecasts are issued by the National Weather Service at 0500, 1100, 1700, and 2300 UTC for WWV.

Since March 1990 the U.S. Coast Guard has sponsored two voice announcements per hour on WWV giving current status information about the GPS satellites and related operations. The 45-s announcements begin at 14 and 15 minutes after each hour .

WWV radiates 10,000 Watts on 5, 10, and 15 MHz. The WWV antennas are half-wave dipoles that radiate omnidirectional patterns.

The station uses double sideband amplitude modulation. The modulation level is 50 percent for the steady tones, 25 percent for the BCD time code, 100 percent for the seconds pulses and the minute and hour markers, and 75 percent for the voice announcements.

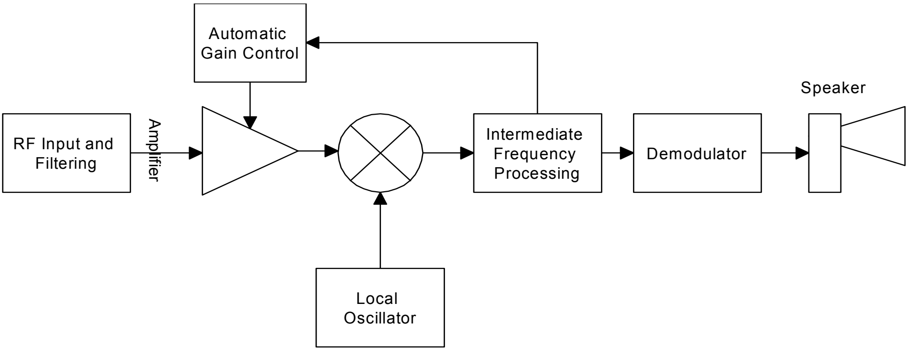
Wow! That's a lot of information being broadcast. Sure wish we had a way to reliably tune it in without spending a couple of hundred dollars on a fancy short-wave receiver.

Enter the Ramsey HFRC1 high frequency receiver. Using today's superior integrated circuit technology and an elegant demodulation scheme, we've come up with a great circuit that performs admirably with a minimum of tuning. With superior sensitivity, selectivity, and dynamic range we offer the easiest and most reliable way to lock a receiver on the NIST!

HFRC1 CIRCUIT DESCRIPTION

The following paragraphs describe some of the circuit theory for our 10 MHz receiver kit. Have a look at the block diagram (pg. 5) and schematic diagram (pg. 12) and follow along.

We'll start by describing the entire circuit operation with a simple block diagram. It's not all that complicated; lets talk our way through it. The RF input (antenna) is bandpass filtered to allow only the signals of interest to be passed through to the RF amplifier. This amplified RF signal is then "mixed"



with an appropriate “local oscillator” signal to produce an easier to work with intermediate frequency, or IF signal. The mixing process produces two signals, one at the sum of the two frequencies (much too high in frequency to work with) and the difference between the RF and LO (our desired IF frequency).

Now that we have our lower frequency IF, we would like to be able to adjust the gain of our RF amplifier to provide for optimum reception and demodulation. This feedback loop is labeled the “Automatic Gain Control” block of the circuit. This is an essential part of a quality receiver to provide for stable operation whether the signal is in the noise or booming in, it continuously adjusts for optimum demodulation levels. A benchmark of the receiver's quality is the “dynamic range” of this circuit, or the amount the input signal may vary without causing distortion on the demodulated output.

Once our IF frequency has been established, we can further filter this signal and then demodulate the information contained on it. Once demodulated, it is a simple job to amplify this information and drive a small speaker.

Now have a look at the schematic (pg. 12) for the unit and follow along. The power source for the receiver kit needs to be regulated to provide for drift free operation of the oscillator circuit that is contained in the kit. We also wanted to provide for either portable battery operation or continuous operation from an external DC supply. This is accomplished using the LM7809 voltage regulator IC and associated components. The two diodes (D2 and 3) ensure that the external supply and the battery circuit will not interfere with each other during normal operation. The diode provides a “one way” path for the supply current. The power indicator LED provides a visual display when the circuit is energized.

Now on to the RF section of the circuit. The RF input filter consists of L1, 2 and the capacitors contained between the two. These components filter out the unwanted signals so as not to saturate out sensitive receiver circuits. Transistor Q1 provides the RF gain for our circuit. Fairly straightforward up until now, but get ready for some magic.

Remember, as previously stated the RF signal originated from the WWV transmitter is *amplitude modulated*, whereas the receiver IC we have chosen (Motorola 3371) is a complete *frequency demodulation* chip. Oops ! Doesn’t make a lot of sense so let us explain it.

Here’s the secret to the super performance of the unit. Recall that one of our design goals was to maximize the dynamic range of the unit. The 3371 IC has a dynamic range of 60 dB, or about 1,000,000:1, on the **R**eceived **S**ignal **S**trength **I**ndicator, or RSSI output. Since this IC was designed for cellular telephone applications an important function of the chip was to determine the amount of input signal to the receiver (for cellular applications; this measurement is used to vary the transmit power of the telephone; that's why those batteries last longer when you're in town and not a significant distance from the cell site). That kind of dynamic range was unheard of just a few years ago; in fact most quality short-wave receivers used a pair of amplifiers to accomplish this task !

This RSSI output is ideal for our AGC control of the RF preamplifier; but we are still "stuck" in trying to recover AM modulated signals from an IC designed to FM demodulate. But wait, there's more! This RSSI recovered signal contains the AM modulated information, albeit in a logarithmic format. To recover our audio, we need an antilog circuit to give us a linear output from a log input. The circuit arrangement of U2 A, B, and C in conjunction with transistors contained in U3 B and C perform this function by driving the emitter of the transistor contained in U3:B from the amplifier contained in U2:A and the transistor contained in U3:C. The collector current of the "U3:B" transistor varies exponentially with the emitter-base voltage, and is converted to the output voltage by the amplifier contained in U2:D.

A further complication of this antilog type of circuit is that the transistors should be specifically matched for this application. Well once again our crafty engineers took this into account and chose the two transistors that are internal (and previously unused) on the LM389 audio amp IC. Talk about your matched transistor pair, these two transistors exist together on the same piece of silicon!

The local oscillator section of the circuit consists of crystal X1 and associated capacitors. This oscillator "sings at the appropriate frequency to mix our desired 10 MHz RF signal down to the 450 KHz desired IF, which is further filtered by the 450 KHz crystal filter, FL1.

The last bit of circuit is the rest of the LM389 audio amplifier, which boosts our demodulated WWV signal to provide enough power to drive a small speaker. By inserting an external speaker or headphone into J3, the internal speaker is muted.

HFRC1 COMPONENTS LIST

Sort and "check off" the components in the boxes provided. It's also helpful to sort the parts into separate containers (egg cartons do nicely) to avoid confusion while assembling the kit.

RESISTORS AND POTENTIOMETERS

☐	1	2 ohm (red-black-gold) [R21]
☐	1	100 ohm (brown-black-brown)[R3]
☐	1	470 ohm (yellow-violet-brown) [R4]
☐	2	1K ohm (brown-black-red) [R5,22]
☐	1	2.2K ohm (red-red-red) [R18]
☐	7	10K ohm (brown-black-orange) [R2,10,11,15,16,17,19]
☐	1	33K ohm (orange-orange-orange) [R1]
☐	3	47K ohm (yellow-violet-orange) [R6,12,14]
☐	4	100K ohm (brown-black-yellow) [R7,8,9,13]
☐	1	PC mount 10K trimmer potentiometer (10K) [R20]

CAPACITORS AND INDUCTORS

☐	1	1 pF disc capacitor (labeled 1) [C2]
☐	3	22 pF disc capacitors (labeled 22) [C1,3,11]
☐	1	47 pF disc capacitor (marked 47) [C15]
☐	1	100 pf (marked 100 or 101) [C19]
☐	5	.001 uF (marked 1000 or 102) [C4,5,7,17,21]
☐	2	.01uF disc capacitors (labeled .01 or 103 or 10nF) [C6,12]
☐	8	.1uF disc capacitors (labeled .1 or 104) [C8,9,10,13,16,18,22,25]
☐	5	10 uF electrolytic capacitor (labeled 10uF) [C14,20,23,27,28]
☐	2	220 uF electrolytic capacitors (labeled 220uF) [C24,26]
☐	2	Slug tuned transformers (silver can with 5 leads marked 421F) [L1,2]

SEMICONDUCTORS AND INTEGRATED CIRCUITS

☐	1	7809 9VDC regulator IC (marked 7809) [VR1]
☐	3	1N4148 small signal diodes (pink glass case with black band) [D1,2,3]
☐	1	Jumbo LED (light emitting diode) [D4]
☐	2	NPN Transistors (Three leads marked 2N3904) [Q1,2]
☐	1	Motorola MC3371 receiver IC (16 pin DIP IC marked 3371) [U1]
☐	1	LM324 op amp IC (14 pin dip labeled LM324) [U2]
☐	1	LM 389 audio amplifier IC (18 pin DIP IC marked 389) [U3]

MISCELLANEOUS COMPONENTS

☐	1	9.550 MHZ crystal (small silver can labeled 9.54) [X1]
☐	1	450 KHz IF filter (small black cube with three connection pins)[FL1]
☐	1	PC mount push-button switch [S1]
☐	1	PC mount power jack [J1]

❒ 1 PC mount RCA type jack [J2]
❒ 1 PC mount mini jack [J3]
❒ 1 9 volt rectangular battery “snap” connector
❒ 1 9 volt battery clip
❒ 1 Miniature 8 ohm speaker [SP1]

RAMSEY LEARN-AS-YOU-BUILD KIT ASSEMBLY

There are numerous solder connections on the HFRC1 printed circuit board. Therefore, PLEASE take us seriously when we say that good soldering is essential to the proper operation of your receiver!

- Use a 25-watt soldering pencil with a clean, sharp tip.
- Use only rosin-core solder intended for electronics use.
- Use bright lighting, a magnifying lamp or bench-style magnifier may be helpful.
- Do your work in stages, taking breaks to check your work. Carefully brush away wire cuttings so they don't lodge between solder connections.

We have a two-fold "strategy" for the order of the following kit assembly steps. First, we install parts in physical relationship to each other, so there's minimal chance of inserting wires into wrong holes. Second, whenever possible, we install in an order that fits our "Learn-As-You Build" Kit building philosophy. This entails describing the circuit that you are building, instead of just blindly installing components. We hope that this will not only make assembly of our kits easier, but help you to understand the circuit you’re constructing.

For each part, our word "Install" always means these steps:

1. Pick the correct part value to start with.
2. Insert it into the correct PC board location.
3. Orient it correctly, follow the PC board drawing and the written directions for all parts - especially when there's a right way and a wrong way to solder it in. (Diode bands, electrolytic capacitor polarity, transistor shapes, dotted or notched ends of IC's, and so forth.)
4. Solder all connections unless directed otherwise. Use enough heat and solder flow for clean, shiny, completed connections.
5. Trim or “nip” the excess component lead wire after soldering.

NOTE: Save some of the longer wire scraps nipped from resistors and capacitors. These will be used to form wire jumpers (JMP1, etc.) to be soldered in just like parts during these construction steps.

Enough of that ... lets get started!

HFRC1 NIST 10 MHZ RECEIVER ASSEMBLY STEPS

Although we know that you are anxious to complete the assembly of your receiver kit, it is best to follow the assembly steps in this manual. Try to avoid the urge to “jump ahead” installing components.

Since you may appreciate some “warm-up” soldering practice as well as a chance to put some “landmarks” on the PC board, we’ll first install some of the larger mounting components. This will also help us to get aquainted with the up - down, left - right orientation of the circuit board. Remember that the components will be mounted on the “component “ side of the circuit board and soldered on the “solder “ side of the circuit board, the side with the printed circuit traces. Have a look at the component layout diagram to help with your assembly.

❒ 1. Install S1, the push-button switch. Be sure to push the part as close to the circuit board as it will go, as the alignment of this part is important in getting the case holes to line up with the part. Solder all six leads.

❒ 2. Identify and install the 10K trimmer potentiometer R20 (labeled 10K). Gently “rock” the component into place before soldering. Be sure to solder the mounting “tabs” into place to provide for a secure fit.

❒ 3. Moving to the rear of the board, install J1,a PC mount power type connector. Again, be sure to push the component firmly into place. Solder all three connection points.

❒ 4. Still working at the rear of the board, install J2,a PC mount RCA type connector. Again, be sure to push the component firmly into place. Solder all four connection points.

❒ 5. Install J3,a PC mount miniature type earphone connector. Solder all three connection points.

Now it’s time to build the power supply portion of the circuit. We use a LM7809 voltage regulator to provide a stable source of power for the circuit.

❒ 6. Identify VR1, the 7809 voltage regulator IC. Notice that the parts diagram shows that the “flat” longer side with an optional mounting hole is faced towards the rear of the circuit board. Install as shown in the parts placement diagram.

❒ 7. Identify C27, the 10 uF electrolytic capacitor. Electrolytic capacitors are polarized with a (+) and (-) lead and must be installed in the correct orientation. Ordinarily, only the negative side is marked on the capacitor body with a dark band and the (-) sign clearly shown, while the PC boards will usually show the (+) hole location. Use care to ensure proper polarity. See the parts diagram for proper placement. The capacitor should fit snugly down to the PC board.

☐ 8. In the same manner, install electrolytic capacitor C28, 10 uF. Remember to orient the polarity correctly, as shown in the parts placement diagram.

We'll forego mounting the battery snap connector for now, since it is easier to flip the board over back and forth to aid in component mounting without the wires flapping around.

☐ 9. Identify one of the 1N4148 glass type diodes. Notice how one end is marked with a black band. Be sure that this band is oriented as shown in the parts diagram, and install in the D3 position.

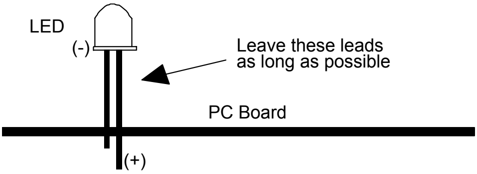
☐ 10. In the same manner, install diode D2. Again, be sure that the banded end is oriented as shown in the parts diagram.

☐ 11. Using a scrap component lead, form a jumper wire and install in the JMP6 holes. Jumpers are like electronic "bridges" that carry signals over the PC board traces.

☐ 12. Install R22, 1K ohm (brown-black-red).

☐ 13. Install LED D4. Being a diode, this component is polarized and must be oriented correctly. Examine the LED and notice how one lead is longer than the other. The longer of the two leads is the anode, or (+) connection. Most diodes also have a flat side molded in the component body. This corresponds to the cathode or (-) side of the part.This flat should face in the direction of the band marking of the diode. Leave the diodes leads as long as possible as this component will also mount to the front panel as a power indicator.

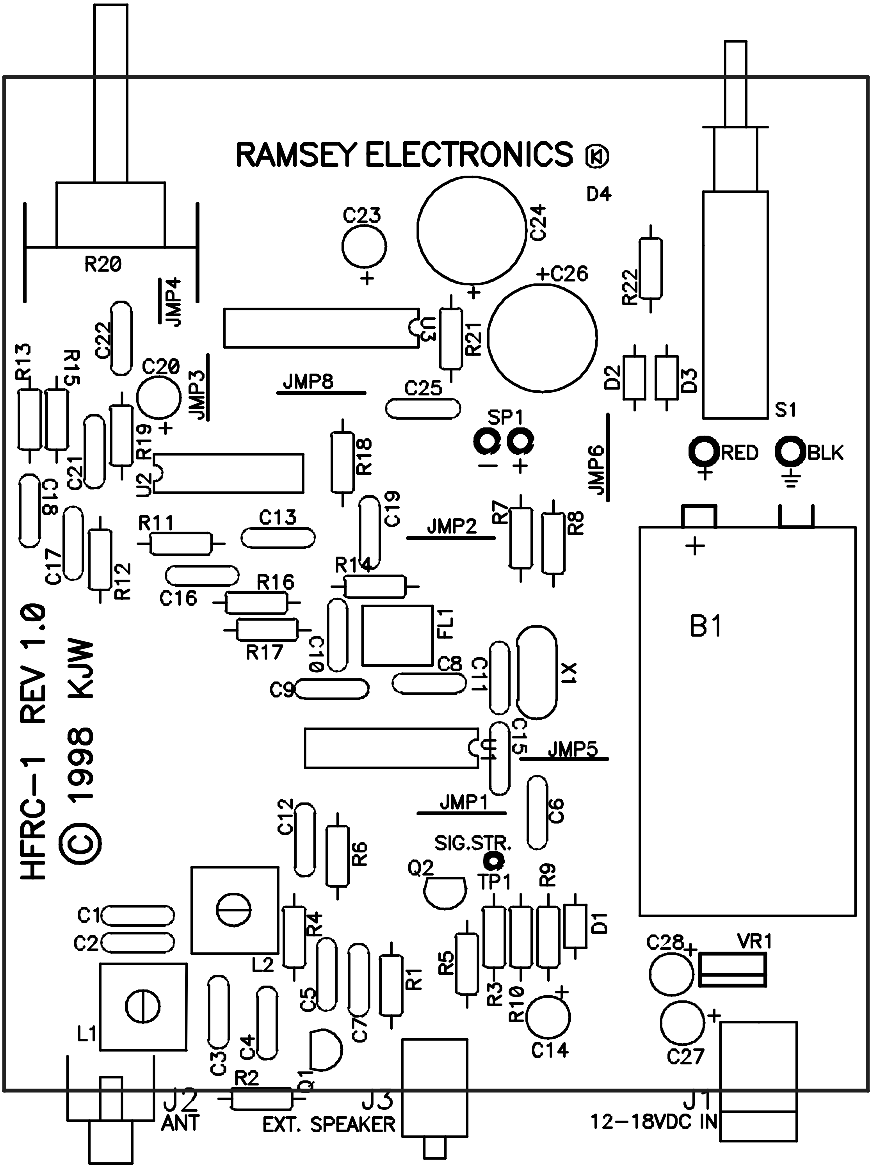
Now that wasn't so bad was it! You've just completed the power supply part of your WWV receiver. Pretty soon now you be listening to the 'ol "at the tone...coordinated universal time"!



Next we'll work on the RF section of the circuit. Be sure to mount the components as close to the printed circuit board as possible to provide for a minimum of parasitic inductance or capacitance which could inhibit proper operation.

☐ 14. Identify L1 (silver can transformer marked 421F). Install L1 next to J2 towards the rear of the unit. Make sure that the 5 pins line up correctly to

HFRC1 COMPONENT LAYOUT



assure proper orientation.

- ❒ 15. Install C2, 1 pF disc capacitor (marked 1). Remember to tuck this component down securely before soldering.
- ❒ 16. Install C1, 22 pF disc capacitor (marked 22).
- ❒ 17. Install C3, 22 pF disc capacitor (marked 22).
- ❒ 16. Install C4, .001 uF disc capacitor (marked 1000 or 102). Remember to save a few of those scrap leads for future jumper wires.
- ❒ 17. Install L2, the other silver can transformer labeled 421F. Again, make sure that the 5 pins line up correctly to assure proper orientation.
- ❒ 18. Install R4, 470 ohm (yellow-violet-brown).
- ❒ 19. Install C5, .001 uF disc capacitor (marked 1000 or 102).
- ❒ 20. Install C7, .001 uF disc capacitor (marked 1000 or 102).
- ❒ 21. Locate and install Q1, a 2N3904 transistor. Transistors have three "legs" and must be oriented correctly. Notice that the part contains a "flat" side with the writing imprinted on it. Be sure to follow the parts diagram for correct placement. To install, slide the center legs through the circuit board and push the component as close to the board as possible without "straining" the leads. Solder all three connections securely.
- ❒ 22. Install R2, 10K ohm (brown-black-orange).
- ❒ 23. Install R1, 33K ohm (orange-orange-orange).
- ❒ 24. Install R5, 100 ohm (brown-black-brown).
- ❒ 25. Identify and install 10uf electrolytic capacitor C14, using care to orient the + side as shown in the parts diagram.

Great job up until now! Take a moment to check your previous solder joints for “opens” where the solder did not completely flow around the connection or solder “bridges” between closely spaced pads or IC pins. It seems the best time to identify these type of problems is now when you're focused on this section of the board, saving you time troubleshooting later.
Lets continue with the MC3371 IC section of the receiver.

- ❒ 26. Install R3, 1K ohm (brown-black-red).
- ❒ 27. Install R10, 10K ohm (brown-black-orange).
- ❒ 28. Install R9, 100K ohm (brown-black-yellow).
- ❒ 29. Identify the last of the 1N4148 glass type diodes. Notice how one end is marked with a black band. Be sure that this band is oriented as shown in the parts diagram, and install in the D1 position.
- ❒ 30. Locate and install Q2, the last 2N3904 transistor. Notice that the part contains a "flat" side with the writing imprinted on it. Be sure to follow the parts diagram for correct placement. To install, slide the center

legs through the circuit board and push the component as close to the board as possible without "straining" the leads. Solder all three connections securely.

❒ 31. Install R6, 47K ohm (yellow-violet-orange).

❒ 32. Install C12, .01uF disc capacitor (marked .01 or 103 or 10nF). Remember to save those scrap component leads; you'll be needing them next.

❒ 33. Using a scrap component lead, form a jumper wire and install in the JMP1 holes.

❒ 34. Install C6, .01uF disc capacitor (marked .01 or 103 or 10nF).

❒ 35. Form and install jumper J5.

❒ 36. Install U1, the MC3371 mixer/oscillator/detector IC. Make sure to align the notch or dot associated with pin one with the notch shown in the parts layout diagram. Also check to be sure all 16 pins are through the board before soldering the IC in place. This IC is responsible for the local oscillator, mixing, and demodulating circuits and replaces a few dozen discreet components.

❒ 37. Install C15, 47 pF (marked 47).

❒ 38. Locate X1, the 9.550 MHz crystal. Crystals are exactly what they say they are, quartz crystals mounted in a tin can. The nature of their structure makes them ring at a specific predictable frequency. This component may be mounted either way, just be sure to snug it up to the PC board. Use care as not to feed in too much solder when attaching as a lump of solder from the mounting pad to the can would cause the device to short out and not generate the proper frequency.

❒ 39. Install C11, 22 pF disc capacitor (marked 22).

❒ 40. Install C8, .1uF disc capacitor (marked 104).

❒ 41. Install C9, .1uF disc capacitor (marked 104).

❒ 42. Identify and install the small cubic 450 KHz IF filter. Since the crystal structure only vibrates at a specific frequency, it may also be used to “filter” frequencies, rejecting the ones that do not cause it to resonate. Position the three pins so that the component mounts as shown in the parts diagram.

❒ 43. Install C10, .1uF disc capacitor (marked 104).

❒ 44. Install R14, 47K ohm (yellow-violet-orange).

❒ 45. Install R17, 10K ohm (brown-black-orange).

❒ 46. Install R16, another 10K (what were those colors?).

❒ 47. Install C16, .1uF disc capacitor (marked 104).

❒ 48. Install R11, 10K ohm (brown-black-orange).

❒ 49. Install C13, .1uF disc capacitor (marked 104).

❒ 50. Install C19, 100 pF disc capacitor (marked 100 or 101).

❒ 51. Using a scrap component lead, form a jumper wire and install in the JMP2 holes.

❒ 52. Install R7, 100K ohm (brown-black-yellow).

❒ 53. Install R8, 100K ohm (brown-black-yellow).

That's a lot of parts! Take a break and rest your weary eyes. Have a look in your new Ramsey catalog and dream of the next kit that you want to tackle!

Before you start up again, carefully inspect all of your solder connections completed until now; touch up with your soldering iron any less than perfect connections.

Now we'll get going on the final push, the antilog converter and amplifier section of the receiver.

❒ 54. Install R18, 2.2K ohm (red-red-red).

❒ 55. Install C25, .1uF disc capacitor (marked 104).

❒ 56. Form and install jumper JMP8.

❒ 57. Form and install JMP3.

Now that your soldering skills are at their peak, we'll install the two remaining IC's.

❒ 58. Install U2, the LM324 op amp IC. Make sure to align the notch or dot associated with pin one with the notch shown in the parts layout diagram. Also check to be sure all 14 pins are through the board before soldering the IC in place.

❒ 59. Install U3, the LM389 audio amp IC. Make sure to align the notch or dot associated with pin one with the notch shown in the parts layout diagram. Also check to be sure all 18 pins are through the board before soldering the IC in place.

❒ 60. Install R21, 2 ohm (red-black-gold). This resistor prevents the audio oscillator from breaking into oscillation or "motorboating" as the lads around here call it.

❒ 61. Install C26, 220 uF electrolytic capacitor. Be sure to orient the part correctly. See the parts layout diagram for proper placement.

❒ 62. In the same manner, identify and install C24, another 220 uF electrolytic. Watch that polarity!

❒ 63. Identify and install the 10 uF electrolytic capacitor, C23. Remember to orient the polarity correctly, as shown in the parts placement diagram.

❒ 64. Form and install jumper JMP4.

❒ 65. Install the last 10 uF electrolytic capacitor, C20. Remember to orient the polarity correctly, as shown in the parts placement diagram.

❒ 66. Install C22, .1uF disc capacitor (marked 104).

❒ 67. Install R19, 10K ohm (brown-black-orange).

❒ 68. Install C21, .001 uF disc capacitor (marked 1000 or 102).

❒ 69. Install R12, 47K ohm (yellow-violet-orange).

❒ 70. Install C17, .001 uF disc capacitor (marked 1000 or 102).

❒ 71. Install C18, .1 uF disc capacitor (marked 104).

❒ 72. Install R13, 100K ohm (brown-black-yellow).

❒ 73. Install R15, 10K ohm (brown-black-orange).

❒ 74. Install the 9V battery connector to the “RED” and “BLK” holes, respectively.

❒ 75. Using the speaker wire and the mini speaker provided, solder the wires to the input terminals of the speaker and then to the speaker terminals on the circuit board.

Whew! Well, that's about it for the main circuit board assembly. Take a few minutes to double check your work, especially the placement of the polarized and orientation specific components.

CONGRATULATIONS

Your WWV receiver is now complete! Have a final look over your work, paying particular attention to the orientation of diodes, transistors and IC’s.

INITIAL TESTING OF THE RECEIVER

This kit was purposefully designed to “plug and play” with minimal testing upon completion. Install a fresh nine volt battery and depress the power switch. The power on led should illuminate. Turn the volume control to about half, connect a suitable antenna to the RF input; and the Colorado “beep” will magically (not really) appear. You may alternately adjust L1 and L2 for maximum signal strength. A meter placed between TP1 and ground will indicate signal level and L1 and 2 may be adjusted for maximum voltage at TP1.

TROUBLESHOOTING INSTRUCTIONS

While we had hoped that it wouldn’t come to this, if you are having trouble with your HFRC1 receiver, here are a few suggestions.

Use a methodical, logical troubleshooting technique. Most problems can be solved using common sense. A volt-ohm meter and a clear head are usually all that are needed to correct any problem. Most problems are due to misplaced parts and/or bad solder connections. Working backwards through the assembly steps will often lead you to the problem.

CONCLUSION

We sincerely hope that you enjoy the use of this Ramsey product. As always, we have tried to compose our manual in the easiest, most "user friendly" format that is possible. As our customers, we value your opinions, comments, and additions that you would like to see in future publications.

And once again, thanks from the folks at Ramsey!

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully, all information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and its sad to say that our human construction skills have not! But on rare occasion a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:
To qualify for Ramsey Electronics factory repair, kits MUST:
1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of $25.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.
The repair is $50.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).
4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

National Institute of Standards and Technology (NIST)
WWV 10 MHZ RECEIVER
Quick Reference Page Guide

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REQUIRED TOOLS

- Soldering Iron Ramsey WLC100
- Thin Rosin Core Solder Ramsey RTS12
- Needle Nose Pliers Ramsey MPP4 or RTS05
- Small Diagonal Cutters Ramsey RTS04

<OR> Technician’s Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS

- Holder for PC Board/Parts Ramsey HH3
- Desoldering Braid Ramsey RTS08
- Digital Multimeter Ramsey M133

Price: $5.00
Ramsey Publication No. HFRC1
Instruction manual for:
RAMSEY MODEL NO. HFRC1
10 MHz WWV RECEIVER

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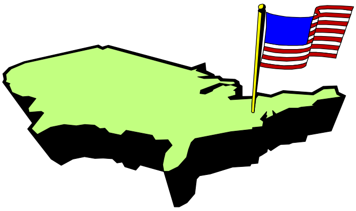

This Quality Electronics Kit
was designed and packed
in the USA